positive displacement pumps (not shown) or one pump may be fluidly coupled to an inlet **1110** in each of the manifolds. The manifolds **1108** as described are in fluid communication with one or more fluid reservoirs via one or more pumps. Control logic **200** sends the appropriate control information to cause the positive displacement pumps to transfer fluid from an internal reservoir (not shown) in the device through the manifold and into the channels and hence the chambers molded into the rear surface of the flexible skin structure **1100**. The hydraulic actuation structure includes in this example, the substrate **1104** that includes one or more fluid channels **1106** and the flexible skin structure **1100** is suitably affixed to the substrate either directly or through any suitable intermediate structures. The flexible skin structure **1100** includes a plurality of fluid pockets also shown as **1102** corresponding to texture features. The fluid pockets **1102** are in fluid communication with the fluid channels **1106** to allow fluid to be added to or removed from the chamber to actuate or deactuate the respective texture feature.

[0052] In one example, as noted above, fluid pumps may be controlled via control logic. In another embodiment, the pumps may be activated via mechanical movement of a movable portion of the housing, such as a movement of a clam shell such that, for example, the rotational movement of a housing portion causes the fluid to be pumped into the fluid chambers. In one example, the pump is controlled to reverse fluid flow when the flip portion is closed. As such, there may be a fluid pump operative to move fluid into the fluid passages (and out of the passages) and a movable housing portion that is coupled with the fluid pump such that mechanical movement of the housing portion causes the fluid pump to pump fluid in at least one fluid passage. The movement of the movable housing portion in another direction may serve to remove fluid from the one or more respective chambers and return it to an internal reservoir.

[0053] FIG. **14** illustrates another embodiment of a hydraulic actuation structure and flexible skin structure that in this example, shows fluid channels **1400** with additional fluid channels **1402** connected with specific chambers that are molded into a rear surface of the flexible skin structure **1100**. The flexible skin structure includes multiple features wherein movement of each of the features is controlled independently. The fluid channels **1400** are in fluid communication with the manifold **1404** whereas other chambers **1401** are in fluid communication with manifold **1406**. As also shown, suitable pump inlets **1408** and **1410** are shown that are in fluid communication with pumps (not shown). In addition, light sources **1412** and **1414** are positioned in proximity to the respective manifold **1404** and **1406** to serve as a light source (such as one or more colored LEDs) and a clear fluid may be used to act as a light guide to direct the light from the internal light sources to, for example, translucent flexible portions of the flexible skin structure. Alternatively, the fluid itself may be colored so as to make the raised texture elements visually distinct by the change in color due to the color fluid contained therein. Any other suitable combination may also be employed if desired. The light sources may be suitably controlled to turn on and off as desired based on an incoming call, user programmed sequence, be activated by a ring tone, or may be controlled in any other suitable manner by the control logic.

[0054] FIG. **15** illustrates one example of the portable electronic device **1500** with the appearance of a 3D pattern with five tactile surfaces being actuated. Unactuated portions **1502** are shown to be flat in this particular example.

[0055] FIG. **16** illustrates an alternative embodiment wherein the flexible skin structure **1600** includes molded pocket patterns **1602** in an under portion thereof to receive fluid. A rigid substrate **1604** includes the suitably positioned fluid channels **1606** that are in fluid communication with one or more manifolds **1608** and also include a pump inlet. The manifold **1608** is attached to a rear side of the right substrate **1604** and is in fluid communication with channels **1606** through openings **1610**. Each of the microchannels include, for example, openings **1610** to allow fluid to pass from the manifold into the channel **1606** as described above. One or more pumps may also be used as noted above to raise and lower the pattern **1602** by passing fluid in or out of the channel **1606**. As such, in this example, if the pattern **1602** is placed, for example, on the back of a cell phone or on the face of a cell phone, the outer skin of the cell phone may be activated to give a three dimensional texture that may be suitably activated and deactivated as desired. The channels **1606** may be positioned with sufficiently fine spacing that they provide any suitable texture pattern to be actuated. It will also be recognized that the skin texture may have one or more cover layers to protect the skin texture from damage from ultraviolet radiation, physical scratches, or any other potential hazards.

[0056] FIG. **17** is a block diagram illustrating one example of the structure **1700** for controlling the hydraulic controllable skin texture surface examples noted above. The device may include one or more fluid pumps **1702** which provide fluid **1704** to and from the controllable skin texture surface. Control logic, in one example, shown as **200** provides suitable control information **1708** in the form of analog or digital signals, for example, to control the one or more fluid pumps **1702** to provide the fluid **1704** in a controlled manner to actuate and deactuate one or more portions of a flexible skin to provide a three dimensional tactile configuration as desired. It will also be recognized that instead of a fluid, a pressurized gas could be employed.

[0057] FIGS. **18***a* and **18***b* illustrate another embodiment wherein, instead of a sliding ramp structure (for example as shown in FIGS. **6** and **7**), a plurality of hinged elements **1830** that have an anchored portion **1832** attached to the flexible skin structure **320** through a suitable adhesive or through any other suitable attachment mechanism. Each of the hinged elements **1830** also have a movable section **1834**. The flexible skin structure **320** includes pins **1836** which are, for example, longer than those shown in FIG. **6**.

[0058] The device further includes a substrate **1840** such as, for example, a printed circuit board which has attached thereto, dome switches **1842** as known in the art. The dome switches **1842** are positioned to align under the pins. A flexible sliding member **1846** is interposed between the substrate **1840** and the anchored portion **1832** underneath the flexible skin surface **320**. The flexible sliding member **1846** may be made from, for example, nylon or polypropylene sheet, or other suitably flexible material that allows motion of the movable section of the hinged element **1834** to be transferred to the dome switch **1842**. Holes **1850** in the flexible sliding member **1846** allow the movable sections of hinged elements **1834** to rotate downward toward the substrate **1840**, as shown in FIG. **18***a*. It can be seen that when the flexible sliding member **1846** is in the position shown in FIG. **18***a*, the end of the movable section of the hinged element **1834** may be